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Abstract

Purpose – Generalized audit software (GAS) is the tool use by auditors to automate various audit tasks. As most accounting transactions are now computerized, auditing of accounting data is also expected to be computerized as well. While GAS is the most popular of computer assisted audit tools and techniques (CAATTs), research shows that there is little evidence that GAS has been universally adopted by external auditors. The purpose of this paper is to investigate the utilization of GAS by external auditors in the UK. The paper focuses on small and medium-sized audit firms in the UK whereas most other GAS studies have examined "Big 4" firms. Registered statutory auditors have been selected as a sample.

Design/methodology/approach – A framework was developed to identify a range of relevant factors which are important when considering the application of GAS. A web-based survey has been used to gather the perceptions based on the responses from 205 statutory auditors across the UK. The questions posed to respondents were mapped against the framework.

Findings – The research finds that the utilization of GAS is unusually low among audit firms in the UK. About 73 per cent of external auditors make no use of GAS, due to the perceived limited benefit of using GAS for auditing small clients. While some respondents recognized the advantages of GAS, they were put off by what they believed to be high implementation costs; significant learning curve and adoption process; and lack of ease of use – they showed a preference for using traditional manual auditing methods instead.

Research limitations/implications – The paper focuses on small and medium-sized auditors, and as such the results cannot be extrapolated to Big 4 auditors. Consequently, the responses and conclusions are relevant to the use of GAS during audits of smaller and medium-sized companies which make up the client base of such audit firms.

Originality/value – This is one of the few studies that have sought to research the utilization of GAS by the external auditor.

Keywords United Kingdom, Small to medium-sized enterprises, Auditing, Auditors, Computer software, Computerised auditing, Generalised audit software, Computerised assisted audit tools and techniques

Paper type Research paper

Introduction

Various computer assisted auditing tools and techniques (CAATTs) have been developed to assist auditors in performing audits on computerized accountancy data. Generalized audit software (GAS) is one of the most commonly used types of CAATTs (Singleton, 2006; Wehner and Jessup, 2005; Debreceny *et al.*, 2005; Braun and Davis, 2003;

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Lovata, 1988). GAS is used by auditors to analyze and audit either live or extracted data from a wide range of applications (Debreceny *et al.*, 2005). GAS is data extraction and data analysis software, which is designed to perform specific audit routines and statistical analysis. For example, it can browse, analyze, sort, summarize, stratify, sample and apply calculations, conversions and other operations to audit a full set of accounting data, as opposed to relying on sampling. While most audits now make use of electronic working papers, the audit process itself is often undertaken without the automation offered by GAS. Auditors still prefer to use traditional auditing procedures in forming an audit opinion based upon a sample of accounting transactions instead of testing all the available data.

While there has been previous research into the adoption of GAS, very little research has focused on its use for external auditing. Existing research either focuses on internal auditing, which has different objectives to external auditing, or on a mixture of internal and external auditing. This study intends to fill the gap in the research literature by evaluating the nature and extent of the utilization of GAS by external auditors.

Most large businesses, which have a turnover greater than £6.5 million or a balance sheet total of more than £3.26 million and an average number of employees more than 50, are required by law in the UK, i.e. The Companies Act, 2006, to be audited by independent auditors annually. These large entities or even small and medium enterprises (SMEs) usually make intensive use of information systems for most of their business and their accounting records. Auditing companies that make use of computerized accounting is sufficient to warrant investment in GAS by external auditors. This study investigates the current usage and their perception of GAS by external auditors.

A web-based online survey has been used to gather the data from external auditors. The research finds that the utilization of GAS is very low among audit firms in the UK. About 73 percent of external auditors make no use of GAS, due to the limited perceived benefit of its use for auditing small clients. While some respondents recognized the advantages of GAS, they were hindered by what they believed to be high implementation costs; learning curve and adoption processes; and the lack of ease of use – they showed a preference for using traditional auditing methods instead. Those who used GAS preferred to use interactive data extraction and analysis (IDEA) as an audit software tool and were mainly using GAS for financial statement auditing.

This paper is organized as follows. Section 2 covers the background of the nature of GAS and the current usage by external auditors. This background leads to the development of the three research questions. Section 3 presents a descriptive analysis of the methods used in this study, while the Section 4 provides the detailed findings from the survey with respect to each of research question. Section 5 summarizes the findings, sets out the limitations of the research and provides implications for future research.

Background and development of research questions

This section discusses prior research on GAS and the topics that led to the development of research questions to ascertain the extent to which GAS is currently adopted by external auditors. The section also seeks to identify the factors that influence whether or not GAS is adopted by external auditors.

Prior research

Most of the studies on GAS usage either examine internal auditors only, a combination of internal auditors and external auditors, or a mixture with other types of auditor including governmental auditors. Different types of auditors have different structures and different audit objectives. Hence, the factors that will lead to the usage of GAS will be different. For example, an internal auditor works within the organization and has direct access to an organization's information systems, while an external auditor works from the outside the organization and has more limited access to client data. Both internal and external auditors also have different audit objectives, where internal auditors are more focused on operational audits, while external auditors focus more so on statutory annual financial statement auditing.

The literature has shown that there is little evidence on GAS usage that specifically focuses on external auditors. For example, Mahzan and Lymer (2008) studied the adoption of CAATTs by internal auditors in the UK. Wehner and Jessup (2005) and Debreceny *et al.* (2005) studied the factors affecting GAS usage on both internal auditors and external auditors. Braun and Davis (2003) focused on governmental auditors in the USA. There are also other surveys conducted by professional accounting bodies, for example The Chartered Institute of Public Finance and Accountancy (CIPFA, 2003) and the Annual Software Survey from 1995 to 2006 by The Institute of Internal Auditor (IIA), which were focused on the use of CAATTs by internal auditors. Lovata (1988) and Lovata (1990) investigated auditors from "Big Eight" accounting firms 20 years ago, but technology usage at that time is arguably obsolete compared with the current technology. Table I shows the list of previous related studies on GAS.

The role of GAS

GAS can help auditors to detect any misstatements in the financial statements, particularly in achieving the general audit objectives of validity, completeness, ownership, valuation, accuracy, classification and disclosure of the data produced by accounting software (Debreceny *et al.*, 2005). Examples of GAS include the audit command language (ACL), IDEA and ProAudit. These software packages allow auditors to interrogate a variety of accounting systems (Debreceny *et al.*, 2005) and conduct a 100 percent analysis of a client's financial data.

With the benefits described above, GAS usage has been encouraged by auditing standards. Janvrin *et al.* (2009a) have identified and tested nine different functions of CAATTs originating from auditing standards issued by the American Institute of Certified Public Accountants (AICPA). In the UK, auditing standards were issued by the Auditing Practices Board (APB, 2004a, b, c, d, e, 2006). Table II shows the details of CAATTs that can be implemented using any GAS according to UK and American auditing standards.

With the wide adoption of technology in a developed country like the UK and the wide functionality and benefits that GAS provides, it should be expected that auditors would use GAS to audit computerized accounting data. Popular accounting software provider Sage have reported that they already provide software and services to over 760,000 small and medium-sized businesses in the UK. The evidence suggests a paradox, in that while there is strong justification for auditors to adopt GAS, the evidence suggests that they do not. In order to quantify the problem and to build on existing evidence, the first research question in this study is:

RQ1. What is the current status of GAS utilization by external auditors in the UK?

Table I.
Prior studies on GAS

Year	Author	Title	Respondent	Theory applied	Method	Key findings
1988	Lovata, L.M.	The utilization of generalized audit software	251 audit manager and 202 EDP auditors from Big Eight accounting firms	Audit Adaptation Model (Davis and Weber, 1986)	Mail survey	Environmental factors appear to influence GAS usage. Understanding of GAS still is a major obstacle for implementing GAS
1990	Lovata, L.M.	Audit technology and the use of computer assisted audit techniques	204 EDP auditing experts from Big Eight accounting firms	Firms Audit Technologies and CAATTs	Mail survey	Low structure firms within Big Eight firms tend to use CAATTs the most followed by high structures firms and then medium structured firms
2001	Bierstaker, James L., Burnaby, Priscilla and Thibodeau, Jay	The impact of information technology on the audit process: an assessment of the state of the art and implications for the future	IT professional from three large international accounting firms – interview and one author attending training session – observation	None	Three interview and one observation by author in audit firm training session	On average it takes two to three years for a company to completely transfer their old software to enterprise-wide computing platforms
2002	Schafer, Brad A., and Eining, Martha M.	Auditor's adoption of technology: a study of domain experts	34 auditors from single Big 5 accounting firms which consist of two group: system auditors and financial auditors	Theory of Planned Behaviour (Ajzen, 1991) and Theory of Acceptance Model (Davis, Bagozzi *et al.*, 1989)	Survey	Firms investing in technology tools should carefully consider the cognitive and emotional components of attitude, subjective norm and perceived behavioral control when investing in technology tools for use in the audit practice
2002	Banker, Rajiv D., Chang, Hsihui, and Kao, Yi-ching	Impact of information technology on public accounting firm productivity	Auditors from five offices of Big 5 accounting firms	Task-Technology Fit (Goodhue and Thompson, 1995)	Interview	The results indicated significant productivity improvement after the adoption of IT
2003	Braun and Davis	Computer assisted audit tools and techniques: analysis ad perspectives	90 auditors from legislative audit office in several states in the USA	Using interview and observation to design the survey	Survey (e-mail and web based questionnaire)	Auditors perceive the potential benefits associated with ACL; however, they displayed a lower confidence in their technical abilities in using the application
2005	Debreceny, Roger, Lee, Sook-Leng, Neo, Willy, and Toh, Jocelyn Shuling	Employing generalized audit software in the financial services sector: challenges and opportunities	Interview with three external auditors and three internal auditors from two banks in Singapore	Exploratory qualitative research	Interview	Internal auditors see GAS primarily as a tool for special investigations rather than as a foundation for their regular audit work. External auditors make no use of GAS, citing the inapplicability of this class of tool to the nature of testing the financial statement assertions or the extent or quality of computerized internal controls maintained by the bank

(*continued*)

Table I.

Year	Author	Title	Respondent	Theory applied	Method	Key findings
2005	Deborah, Wehner, and Jessup, Carol M.	Factors affecting generalized audit software usage	26 internal auditors, 45 external auditors, 55 paper form and 21 e-mailed	Unified Theory of Acceptance and Use of Technology (UTAUT)	Survey – paper form and e-mail	Auditors who have attended courses pertaining to audit software are more likely to use GAS. Staff and senior level auditors are more likely to use GAS than supervisory or management level auditors. Age does not impact GAS usage. Female auditors use GAS more than male auditors
2007	Havelka, Douglas and Merhout, Jeffrey	Development of an information technology audit process quality framework	Internal auditors in health care product and services organization The first group was composed of IT audit managers (4), the second group was composed of financial and operations audit managers and staff auditors (7); and the third group was composed of IT audit seniors and staff (5). Total = 16	Nominal Group Technique	Focus group has been using to identify factors rated as critical by one or more of these groups and develop a first draft of a quality model	This study seeks to determine factors that may influence the IT audit process and develop a model that can be used to improve process quality. Five factors which include client, system, IT audit personnel, IT audit organization and audit process have been determine that effect the IT audit quality
2008	Mahzan, Nurmazilah and Lymer, Andrew	Adoption of computer assisted audit tools and techniques (CAATTs) by internal auditors: current issues in the UK	11 Institute of Internal Auditors (IIA) UK and Ireland, 34 ACL uses, 25 data services UK and 25 IDEA user. Total survey = 95. Case study with 8IA in UK and 2 IA in Malaysia	Unified Theory of Acceptance and Use of Technology (UTAUT)	Survey in the UK and case study in the UK and Malaysia	Four dimensions proposed are proposed in the model of successful adoption (i.e. motivations for CAATTs adoption, best practices for implementation, challenges faced in the adoption process and methods for performance evaluation) are supported by the findings from the quantitative and qualitative data
2008	Curtis, Mary B. and Payne, Elizabeth A.	An examination of contextual factors and individual characteristics affecting technology implementation decisions in auditing	181 participants. In-charge auditors from one Big 4 accounting firm during firm training session. Participants were randomly assigned one of four versions of the research instrument, nine which contained a case study and questionnaire 139 responses	Unified Theory of Acceptance and Use of Technology (UTAUT) and budgeting theories	Case study and questionnaire	Auditors are more likely to implement new technology when they are aware that the managing partner is encouraging implementation within the firm
2008	Janvrin, Diane, Bierstaker James, and Lowe, D. Jordan	An examination of audit information technology usage and perceived importance	181 auditors from Big 4, national, regional and local firms	Descriptive study	Survey	Auditors extensively use a variety of audit applications including analytical procedures, audit report writing, electronic work papers, internet search tools, and sampling and perceive them as important, but use them infrequently. In addition, IT specialist use is infrequent, even by auditors who examine clients with complex IT. IT use and perceived importance varies by firm size

(*continued*)

Year	Author	Title	Respondent	Theory applied	Method	Key findings
2009	Janvrin, Diane, Lowe, D. Jordan, and Bierstaker, James	Auditor acceptance of computer assisted audit techniques	181 auditors from Big 4, national, regional and local firms	Unified Theory of Acceptance and Use of Technology (UTAUT)	Survey	Performance expectancy and facilitating conditions such as organizational and technical infrastructure support influence the likelihood that auditors will use CAATTs. The results suggest that audit firm management may want to develop training programs and enhance their technical support to increase CAAT usage
2009	Janvrin, Diane, Bierstaker, James, and Lowe, D. Jordan	An investigation of factors influencing the use of computer-related audit procedures	181 auditors from Big 4, national, regional and local firms	Descriptive study	Survey	Computer-related audit procedures are generally used when obtaining an understanding of the client system and business processes and testing computer controls. Furthermore, 43 percent of participants indicate that they relied on internal controls; however, this percentage increases significantly for auditors at Big 4 firms

Table I.

Use GAS to	Auditing standard SAS[a]	ISA[b]
Evaluate fraud risks	AU 316.52	ISA 240.70
Identify journal entries and other adjustments to be tested	AU 316.64	ISA 315.84
Check accuracy of electronic files	AU 308.33	ISA 500.11, ISA 500.36
Re-perform procedures (i.e. aging of accounts receivable, etc.)	AU 308.34	ISA 500.37
Select sample transactions from key electronic files	AU 327.19	ISA 240.70, ISA 330.19
Sort transactions with specific characteristics	AU 327.61	ISA 240.70, ISA 330.19
Test an entire population instead of a sample	AU 327.19, AU 327.27	ISA 240.70, ISA 330.19
Obtain evidence about control effectiveness	AU 316.54	ISA 330.30
Evaluate inventory existence and completeness	AU 314.11	ISA 240 Appendix 2

Table II.
Functions of GAS

Notes: [a]Statement of Auditing Standards (US); [b]International Standard on Auditing (UK and Ireland)

Factors that influence the use of GAS

There are many factors that influence the use of GAS by auditors. For instance, Janvrin *et al.* (2009b) found that performance expectancy and organizational and technical infrastructure support influences the likelihood that auditors will use CAATTs. They surveyed 181 different types of auditors representing Big 4, national, regional and local firms from different regions of the USA to examine the factors that influence individual auditor acceptance of CAATTs. Wehner and Jessup (2005) studied individual factors, i.e. auditor's perception, auditor's career, age and gender that influence auditors' use of GAS. Mahzan and Lymer (2008) studied IT adoption, particularly of CAATTs among internal auditors, based on the Unified Theory of Acceptance and Use of Technology (UTAUT). Janvrin *et al.* (2009a) studied the extent to which computer-related audit procedures are used and whether two factors – control risk assessment and audit firm size – influence the use of computer-related audit procedures.

Lovata (1988) found three factors that affect the audit procedure used:

(1) the sophistication of the computer system;

(2) the strength of internal controls; and

(3) the characteristics of the client's internal audit department.

Curtis and Payne (2008) suggest that by using longer-term budget and evaluation periods, audit firms have the ability to influence the implementation of GAS.

Havelka and Merhout (2007) have developed a model of IT audit quality which comprise five factors that affect the IT audit quality, after conducting the focus group study on internal auditors in health care product and services organization. These factors include client, IT audit personnel, IT audit organization, target process or system and audit process/methodology factors.

Mahzan and Lymer (2008) proposed a model of successful CAATT adoption by internal auditors, comprised of four dimensions covering the issues of factors influencing motivation, best practices of implementation, performance measurement criteria and challenges that can become barriers to successful implementation. They found that GAS

is widely used by internal auditors in the UK and the factors that influence the usage of GAS include the ability to train employees on the usage of GAS, compatibility of the software within the department and the ability of software to meet the data manipulation needs. Janvrin *et al.* (2009b) also suggest that to increase CAATT usage, audit firm management may want to develop training programs and enhance their computer technical support to increase auditor's degree of ease associated with using CAATTs.

Building on the work of previous research, the next research question seeks to aggregate the adoption factors identified in previous studies to find out:

RQ2. What are the factors that influence the use of GAS?

Factors for not utilizing GAS

While there is evidence of a lack of adoption, there is little research attempting to identify the reasons why external auditors do not use GAS. CAATTs are still underutilized in some public accounting firms (Curtis and Payne, 2008; Janvrin *et al.*, 2008). Debreceny *et al.* (2005) found that there is no evidence that GAS is used by the external auditor in their study. One of the reasons is because the client already has an in-house customized system which has the same capabilities of GAS. However, development of such a bespoke system is costly and requires technical expertise that may not be available to small firms.

For some of the audit firms, auditing remains a manual process and they have not yet fully adopted computerized tools (Chang *et al.*, 2008). The use of GAS typically requires some computer skills. Auditors need to have at least a basic knowledge of databases and data management. This implies a need for general training for auditors to use GAS (Singleton, 2006) with a corresponding cost in terms of time and money. This perceived cost may outweigh the perceived benefits derived from adopting GAS.

It is also quite difficult to acquire the data (Brooks and Lanza, 2006). Sometimes, auditors may also have some difficulty in preparing the data for first use (Braun and Davis, 2003), i.e. converting the data from client's system to auditor's system and identify the appropriate data needed for analysis. This also needs some encouragement for the auditor to understand the various types of client data before it may be used with audit software.

As the evidence points to a potential drawback of GAS and minimal usage by external auditors, the next research question seeks to find out:

RQ3. What are the reasons that external auditors might choose not to adopt GAS?

Methodology

To answer the above research questions, a research model has been developed. This section describes the development of the research model, the method used for data collection and the nature of the participants involved in this study.

Survey instrument development

There are several theories which have been implemented by information systems researchers to understand technology acceptance and adoption among auditors (Janvrin *et al.*, 2008; Curtis and Payne, 2008). For example, as shown in Table I, Wehner and Jessup (2005), Mahzan and Lymer (2008) and Curtis and Payne (2008) used the UTAUT (Venkatesh *et al.*, 2003); Schafer and Eining (2002) used the applied theory

of planned behavior (TPB) (Ajzen, 1991) and a technology acceptance model (TAM) (Davis, 1989); Banker *et al.* (2002) have applied task-technology fit (TTF) (Goodhue and Thompson, 1995); and Lovata (1988) developed her own audit adaptation model based on Davis and Weber, 1986, model of stress and the systems hierarchy.

In considering the theory adopted by previous researchers, most were focused more on behavioral intention (UTAUT, TPB and TAM) rather than on understanding the actual use of GAS. The issue here is not just about the intended use of technology, but more on understanding the use of technology for different audit tasks. Most auditors probably understand the usefulness of GAS, but the use of such technology may not apply for a certain types of audit task.

To understand the current usage of GAS and the factors that influence its usage, we have modified the model of IT audit quality by Havelka and Merhout (2007) to fit the objectives of this study. They used nominal group techniques to gather the factors that influence the efficiency, effectiveness and quality of the IT audit process. Five different factors have been identified which are client, target process or system, IT audit personnel, IT audit organization and the audit process or methodology factors. These factors form the basis for the questionnaire, but are complemented by other factors from previous research which fit with the objective of this study. Some factors that were not previously investigated have also been identified. From the extensive literature review and the feedback from various academics and auditors, factors that are not tailored to the specificity of GAS usage were excluded from the conceptual model.

Consequently, the six factors below have been determined and are presented in the research model in Figure 1:

(1) Technological factors – factors related to the installation and usage of audit software.

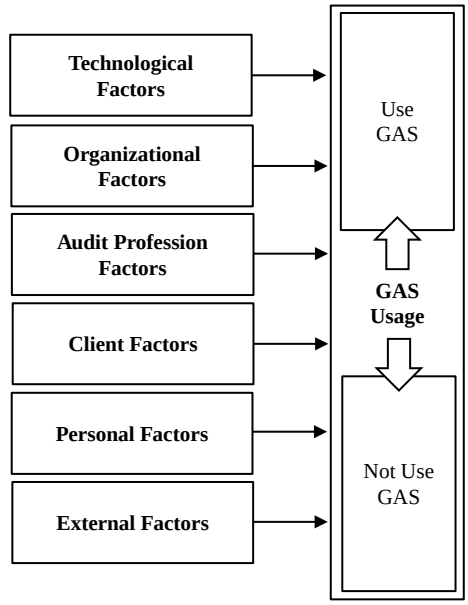

Figure 1.
Research model for GAS utilization

(2) Organizational factors – aspects related to the audit firm.
(3) Audit profession factors – aspects within the audit profession.
(4) Client factors – aspects relating to the client being audited.
(5) Personal factors – factors that are dependent upon the individual auditor.
(6) External factors – factors not included in the above categories.

The details of the research model are elaborated in Table III which summarizes the factors that influence the use of GAS and the sub-items that fall into six categories. There are 41 items that have been identified for the six factors which are derived from the previous literature and feedback from the pilot test.

Participants

An online survey has been used to collect data relating to this research. The questionnaire was pre-tested with 30 participants – 20 lecturers who teach auditing and ten practising auditors. The main purpose of the test was to seek clarification regarding the wording of both questionnaire instructions and questions (Oppenheim, 2001). A total of 49 auditors were then randomly selected for a full pilot survey. A total of eight questionnaires were returned after a period of one month. This represents a response rate of 16 percent and since no reminders had been issued, this return rate was considered sufficient to proceed with the main survey.

As at 1 February 2011, there were a total of 12,716 statutory auditors registered under three recognized supervisory bodies (RSBs) in the UK which are: The Association of Chartered Certified Accountants (ACCA), The Institute of Chartered Accountants in England and Wales (ICAEW) and The Institute of Chartered Accountants of Scotland (ICAS). The questionnaire was distributed electronically to a subset of 3,587 statutory auditors from small and medium sized firms who had publicly available e-mail addresses.

Of the 3,587 questionnaires distributed, 291 e-mails failed to arrive due to incorrect e-mail addresses and 177 actively declined to participate in the survey. These 468 questionnaires were excluded from the calculation of the response rate. After three months and two reminders, 205 completed questionnaires were returned representing a 6.57 percent return rate. While the percentage might be considered low and could affect the ability to generalize the findings, it is still reasonable for this kind of online survey. It is also worth noting that the sample represented a large proportion of the full UK population of auditors.

Result

This section discusses the findings of the study and addresses the research questions.

Demographic results

Table IV indicates that about 67 percent of the respondents are working in small audit firms and 33 percent in medium audit firms. Most of the firms are located in London and South East, which represent 25 and 21 percent, respectively. The rest are from the other regions within the UK. Almost 60 percent of the audit firms were from businesses that had been established for more than 40 years. In terms of firms' audit department size, 27 percent of respondents were from departments with less than five auditors, while in term of overall firms' size, about 37 percent of respondents were from firms with ten to 49 employees.

Element	Description	Factor
Technological factors	Factors related to the installation and usage of audit software	Compatibility of software
		Up-to-date firm's ICT infrastructure
		Ease of use
		Adequate and sufficient documentation to follow
		Easy to modify and upgrade
Organizational factors	Aspects related to the audit firm	Full support from top management
		Strong IT support from IT staff
		Availability of IT audit expertise in organization
		Effective and adequate INTERNAL training for staff
		Effective and adequate EXTERNAL training for staff
		Sufficient implementation cost
		Sufficient maintenance cost
		Enough resource to use GAS
		Instructed by the management to use GAS
		Demand in auditor's promotion policies
		Workloads on multiple audit engagement
		Financial budget on audit engagement
		Sufficient time allocated to audit assignment
Audit profession factors	Aspects within the audit profession	Requirement by auditing standards
		Professional audit judgment
		The existence of audit methodology to follow
		Level of audit risk
		The usefulness of the application for auditing
Client factors	Aspects relating to the client being audited	Strength of client's internal control systems
		Complexity of client's IT environment
		Complexity of client's business environment
		Difficulty of access to client's data
		Client concern about data security
		Client business size
		Support provided by client's IT personnel
Personal factors	Factors that are dependent upon the individual auditor	Experience with computerized auditing
		Experience with larger audit clients
		An attempt to ensure public accountability
		Enough knowledge to use GAS
		Understanding of the application
		Easy to become skillful using GAS
		Prefer to use GAS rather than traditional audit
		IT knowledge
		Use GAS regularly in audit assignment
External factors	Factors not included in the above categories	Adequate technical support from vendors
		Similar application has been used by other audit firms

Table III.
Factors that influence the use of audit software

RQ1 findings

RQ1. What is the current status of GAS utilization by external auditors in the UK?

Interestingly 150 (73 percent) of the respondents indicated that their firm did not make use of GAS. Some of them were even unaware about the existence of GAS. Table V shows that only 55 respondents out of 205 were using GAS, with 35 from mid-tier

Category	Frequency	%
Mid-tier practices	68	33.2
Smaller practices	137	66.8
Total	205	100.0
Location		
London	52	25.4
South East	43	21.0
Scotland	21	10.2
South West	15	7.3
West Midlands	15	7.3
North West	15	7.3
East of England	13	6.3
East Midlands	11	5.4
Yorkshire and the Humber	11	5.4
North East	6	2.9
Wales	3	1.5
Total	205	100.0
Firm age (years)		
Ten or less	23	11.2
11-20	26	12.7
21-30	24	11.7
31-40	10	4.9
Above 40	122	59.5
Total	205	100.0
Number of auditors		
Less than five auditors	55	26.8
5-9 auditors	44	21.5
10-20 auditors	34	16.6
21-50 auditors	31	14.6
Over 50 auditors	47	20.5
Total	205	100.0
Number of employees		
Less than ten employees	26	12.7
10-49 employees	75	36.6
50-99 employees	31	15.1
100-499 employees	49	23.9
500-999 employees	4	2.0
Over 1,000 employees	20	9.8
Total	205	100.0

Table IV.
Profile of audit firms

practice of audit firms and 20 from smaller practices. Similar to the results of previous studies conducted such as Debreceny *et al.* (2005), Greenstein and McKee (2004), Greenstein-Prosch *et al.* (2008) and Janvrin *et al.* (2008), the results of this study also suggest that GAS usage by external auditors is minimal. When asked about number of years for which GAS had been implemented, 91 percent of those who use the software stated that they have been using the software for more than two years.

The results in Table VI show the usage of GAS categorized by the profile of the respondents' profiles and by the type of audit firm. It is noted that 173 (84 percent) of the respondents are male. Only 51 of male respondents used GAS compared to 112 male respondents who did not use GAS. Only four female respondents used

	Category of firm		Total	
	Mid-tier practice	Smaller practice	Frequency	%
Use of GAS				
Yes	35	20	55	26.8
No	33	117	150	73.2
Total	68	137	205	100.0
Number of years using GAS				
Don't know	1	0	1	1.8
Less than one year	2	0	2	3.6
1-2 years	0	2	2	3.6
More than two years	32	18	50	90.9
Total	35	20	55	100.0

Table V.
Use of GAS

GAS compared to 28 female respondents who did not use GAS. When asked about their age range, 93 (45 percent) of the respondents stated that they are in the category of 45-54 years old. In total, 30 of these were using GAS while another 93 were not using GAS.

Most of the respondents (169 or 82 percent) work as a partner of the audit firm of which 46 use GAS. The respondents were also asked to indicate the extent of their audit experience. Results show that 98 percent of respondents had at least six years auditing experience, and 62 percent of them have a minimum experience of 21 years in the field. The demographic data suggests that the responding auditors are quite experienced in their career and are thus able to give well-informed answers to the questions.

When asked about the experience in computerized auditing, 40 percent of respondents had no experience. It was also found that 50 (24 percent) of the respondents had experience from 0 to five years but only 16 of them were using GAS, while another 34 made no use of it. Of the total respondents, 91 (44 percent) stated that they had good IT skills. From those who had good IT skills, 30 of them were using GAS and another 61 were not.

IDEA is still the most popular type of software used for auditing, representing 39 percent of the auditors who use GAS. Most of mid-tier firms have developed their own in-house application to cater for computerized auditing. ProAudit, CCH, IRIS, Mersia and ACL are also among the software that have been chosen by external auditors. Table VII indicates the type of software that has been used for auditing.

GAS also has been widely used in financial statement auditing rather than in other types of auditing. Table VIII indicates the areas in which GAS has been utilized.

This study has also examined the extent to which GAS has been used in auditing. Based on Janvrin *et al.* (2009a) where they cited from the American Institute of CPAs and from UK auditing standards (ISA 240, ISA 315, ISA 330 and ISA 500), there are nine different CAATTs that can be performed using GAS. The use of GAS was measured by agreement through a Likert scale represented by 1-5, where 1 is never, 2 is rarely, 3 is sometimes, 4 is often and 5 is always. The mean responses, shown in Table IX, suggest that respondents assigned higher ratings to evaluate fraud risk (3.67) and to identify journal entries and other adjustments to be tested (3.49).

RQ2 findings

RQ2. What are the factors that influence the use of GAS?

Table VI.
Use of GAS by respondent's profile and firm types

	Using GAS			Not using GAS				
	Mid-tier practices	Smaller practices	Total	Mid-tier practices	Smaller practices	Total	Total	%
Gender								
Male	31	20	51	30	92	112	173	84.4
Female	4	0	4	3	25	28	32	15.6
Total	35	20	55	33	117	150	205	100.0
Auditor age (years)								
18-24	0	0	0	0	1	1	1	0.5
25-34	4	3	7	3	11	14	21	10.2
35-44	6	4	10	12	36	48	58	28.3
45-54	20	10	30	14	49	63	93	45.4
55 and above	5	3	8	4	20	24	32	15.6
Total	35	20	55	33	117	150	205	100.0
Position								
Director	1	2	3	1	2	3	6	1.5
Partner	30	16	46	26	97	123	169	82.4
Audit manager	3	1	4	4	14	18	22	12.2
Senior auditor	0	1	1	1	3	4	5	2.4
Auditor	0	0	1	1	0	1	1	0.5
Audit trainee	1	0	1	0	0	0	1	0.5
IT audit manager	0	0	0	0	1	1	1	0.5
Total	35	20	55	33	117	150	205	100.0
Experience in auditing (years)								
0-5	1	0	1	3	1	4	5	2.4
6-10	2	3	5	0	8	8	13	6.3
11-15	4	1	5	4	21	25	30	14.6
16-20	3	4	7	5	19	24	31	15.1
21 and above	25	12	37	21	68	89	126	61.5
Total	35	20	55	33	117	150	205	100.0
Experience in computerized auditing (years)								
None	0	0	0	13	68	81	81	39.5
0-5	11	5	16	7	27	34	50	24.4
6-10	7	6	13	3	5	8	21	10.2
11-15	8	4	12	7	7	14	26	12.7
16-20	6	3	9	1	2	3	12	5.9
21 and above	3	2	5	2	8	10	15	7.3
Total	35	20	55	33	117	150	205	100.0
IT skill								
Very good	6	0	6	8	24	32	38	18.5
Good	18	12	30	16	45	61	91	44.4
Adequate	8	6	14	8	40	48	62	30.2
Basic	2	2	4	1	6	7	11	5.4
Very basic	1	0	1	0	2	2	3	1.5
Total	35	20	55	33	117	150	205	100.0

Type of GAS	Frequency	%
IDEA	26	39.4
ProAudit	7	10.6
In House Application	7	10.6
CCH	6	9.1
IRIS	3	4.5
Mercia	3	4.5
ACL	3	4.5
Microsoft Excel	2	3.0
Microsoft Access	2	3.0
Others	7	10.6
Total	66	100.0

Table VII.
Type of audit software used

Note: Participant could use more than one audit software

Type of task	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)	*n*	Mean	SD
Financial statement auditing	2	5	8	11	27	53	4.06	1.183
Investigation auditing	12	6	12	7	5	42	2.69	1.370
Continuous auditing	16	5	7	6	10	44	2.75	1.616
Control monitoring	18	7	5	5	7	42	2.43	1.548
Risk management	18	2	4	9	7	40	2.63	1.644
Ad hoc testing	13	6	11	8	5	43	2.67	1.393
Other	15	0	1[a]	0	1[b]	17	1.35	1.057

Table VIII.
Area of GAS usage

Notes: [a]For all statutory audits – pension funds, charities, companies, limited liability partnerships; [b]substantive testing where there is a large population of low value items and/or automated processes

Respondents who indicated that their firm utilized GAS were asked what factors were influential in the decision to employ this technology. Responses of 41 items have been collected to predict auditor usage of GAS. Prior to conducting the factor analysis, Cronbach's α was run to test the reliability of the quantitative data. The result of Cronbach's α demonstrates an α of 0.932. The result of 0.932 is acceptable within a normal context of statistical test where the general guideline states that an α value above 0.8 indicates good reliability (Field, 2009).

Factor analysis was run to find a way to summarize the information contained in a number of original variables into a smaller set of new, composite dimensions or factors with a minimum loss of information (Hair *et al.*, 2010). Hair *et al.* (2010) suggest that if the factor loadings are +0.50 or greater, they are considered very significant and can be used for further analysis. Hair *et al.* (2010) also indicate any item that has more than one significant loading – termed as cross-loading, should be deleted. Out of 41 items, three of them have factor loadings below +0.50 and two items are cross-loaded on two different factors. Thus, a total of five items were excluded from this analysis. The results in Table X show that all of the 36 items exhibit large factor loadings.

Factor one, labeled client, consisted of seven items with factor loadings between 0.874 and 0.719. Factor two, labeled job relevance, consisted of six items with loadings

I used GAS [. . .]	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)	Mean	SD
To evaluate fraud risks	8	8	4	9	26	3.67	1.540
To identify journal entries and other adjustments to be tested	7	7	11	12	18	3.49	1.399
To check accuracy of electronic files	14	7	15	9	10	2.89	1.436
To re-perform procedures (i.e. aging of account receivables, etc.)	14	9	14	10	8	2.80	1.393
To select sample transactions from key electronic files	13	6	13	13	10	3.02	1.434
To sort transactions with specific characteristics	12	6	18	12	7	2.93	1.317
To test entire population instead of sample	13	9	19	7	7	2.75	1.308
To obtain evidence about control effectiveness	13	11	11	8	12	2.91	1.482
To evaluate inventory existence and completeness	15	10	11	9	10	2.80	1.471

Note: $n = 55$

Table IX.
Techniques used in GAS

between 0.715 and 0.575. Factor three, labeled auditing, consisted of five items with loading between 0.867 and 0.557. Factor four, labeled cost and resources (GAS implementation), consisted of four items with loading between 0.769 and 0.591.

Factor five labeled cost and resources (audit engagement), consisted of two items with loading between 0.804 and 0.801. Factor six, labeled technological and IT availability, consisted of five items with loading between 0.804 and 0.544. Factor seven, labeled personal experience, consisted of two items with loading between 0.776 and 0.750. Factor eight labeled personal knowledge, consisted of two items with loading between 0.808 and 0.641. Factor nine, labeled support from management, consisted of three items with loading between 0.709 and 0.556.

Descriptive statistics computed after eliminating some of the variables in the factor analysis are shown in Table XI. The questionnaire asked respondents how strongly the factors influenced their decision to employ GAS. The importance of these factors was measured by agreement through a Likert scale represented by 1-5, where 1 is strongly disagree and 5 strongly agree. In this result, mean predictor variables suggest that respondents assigned a higher mean rating to technological and IT availability (4.05), auditing (3.87) and support from management (3.80). All other factors had mean values more than 3 indicating that the respondents agreed that those factors influenced their decision to use GAS in auditing.

When asked about other factors that influenced the decision to employ GAS, one of the respondents replied:

> We don't use GAS as much as I believe we could, essentially because a lack of understanding at the strategic level, which (a) reduces the budget available for adequate training and (b) fails to provide strategic direction for the effective and efficient use of GAS.

Table X.
Factor analysis for GAS adoption – rotated component matrix[a]

	Component[b]								
	1	2	3	4	5	6	7	8	9
Complexity of client's IT environment	0.874								
Difficulty to access client's data	0.860								
Client concern about data security	0.858								
Support provided by client's IT personnel	0.839								
Complexity of client's business environment	0.798								
Strength of client's internal control systems	0.743								
Client business size	0.719								
Easy to modify and upgrade		0.715							
Demand in auditor's promotion policies		0.713							
Workloads on multiple audit engagement		0.690							
Adequate technical support from vendors		0.670							
The similar application has been used by other audit firm		0.660							
Prefer to use GAS rather than traditional audit		0.575							
The existence of audit methodology to follow			0.867						
Level of audit risk			0.835						
Professional audit judgement			0.782						
Requirement by auditing standards			0.736						
Use GAS regularly in audit assignment			0.557						
Sufficient maintaining cost				0.769					
Sufficient implementing cost				0.765					
Effective and adequate EXTERNAL training for staff				0.756					
Enough resource to use GAS				0.591					
Financial budget on audit engagement					0.804				
Sufficient time allocated to audit assignment					0.801				
Effective and adequate INTERNAL training for staff						0.804			
Ease of use						0.629			
Availability of IT audit expertise in organization						0.612			
Up-to-date firm's ICT infrastructure						0.556			
Adequate and sufficient documentation to follow						0.544			
Experience with larger audit clients							0.776		
Experience with computerized auditing							0.750		
Understanding of the application								0.808	
IT knowledge								0.641	
Full support from top management									0.709
Instructed by the management to use GAS									0.651
Strong IT support from IT staff									0.556

Notes: [a]Rotation converged in 59 iterations; [b]component: 1 – client; 2 – job relevance; 3 – auditing; 4 – cost and resources (GAS implementation); 5 – cost and resources (audit engagement); 6 – technological and IT availability; 7 – personal experience; 8 – personal knowledge; 9 – support from management; extraction method: principal component analysis; rotation method: Varimax with Kaiser normalization

Table XI.
Factors that influence the use of GAS

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)	Mean	SD
Client						3.36	
Complexity of client's IT environment	1	5	19	24	6	3.53	0.879
Difficulty to access client's data	2	5	22	19	7	3.44	0.958
Client concern about data security	3	6	22	21	3	3.27	0.932
Support provided by client's IT personnel	4	6	28	14	3	3.11	0.936
Complexity of client's business environment	2	7	25	17	4	3.25	0.907
Strength of client's internal control systems	1	6	22	21	5	3.42	0.875
Client business size	1	6	21	20	7	3.47	0.920
Job relevance						3.52	
Easy to modify and upgrade	0	1	18	24	12	3.85	0.780
Demand in auditor's promotion policies	2	11	29	9	4	3.04	0.902
Workloads on multiple audit engagement	0	10	19	20	6	3.40	0.915
Adequate technical support from vendors	0	2	20	19	14	3.82	0.863
The similar application has been used by other audit firms	3	4	22	17	9	3.45	1.033
Prefer to use GAS rather than traditional audit	0	8	17	20	10	3.58	0.956
Auditing						3.87	
The existence of audit methodology to follow	1	2	13	21	18	3.96	0.942
Level of audit risk	1	2	7	30	15	4.02	0.850
Professional audit judgement	2	3	12	25	13	3.80	0.989
Requirement by auditing standards	2	9	14	13	17	3.62	1.194
Use GAS regularly in audit assignment	0	4	11	25	15	3.93	0.879
Cost and resources (GAS implementation)						3.71	
Sufficient maintaining cost	0	0	21	27	7	3.75	0.673
Sufficient implementing cost	0	0	21	28	6	3.73	0.651
Effective and adequate EXTERNAL training for staff	2	5	22	18	8	3.45	0.978
Enough resource to use GAS	0	1	13	32	9	3.89	0.685
Cost and resources (audit engagement)					3.64		

(*continued*)

Table XI.

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)	Mean	SD
Financial budget on audit engagement	0	5	18	24	8	3.64	0.847
Sufficient time allocated to audit assignment	0	6	16	25	8	3.64	0.868
Technological and it availability						4.05	
Effective and adequate INTERNAL training for staff	0	0	9	26	20	4.20	0.704
Ease of use	0	2	7	20	26	4.27	0.827
Availability of IT audit expertise in organization	2	0	14	26	13	3.87	0.904
Up-to-date firm's ICT infrastructure	0	3	14	24	14	3.89	0.854
Adequate and sufficient documentation to follow	0	0	14	27	14	4.00	0.720
Personal experience						3.70	
Experience with larger audit clients	0	5	15	27	8	3.69	0.836
Experience with computerized auditing	0	8	8	31	8	3.71	0.896
Personal knowledge						3.71	
Understanding of the application	0	2	15	27	11	3.85	0.780
IT knowledge	0	3	22	26	4	3.56	0.714
Support from management						3.80	
Full support from top management	0	2	8	24	21	4.16	0.811
Instructed by the management to use GAS	2	8	24	12	9	3.33	1.037
Strong IT support from IT staff	0	1	13	31	10	3.91	0.701

Note: $n = 55$

RQ3 findings

Respondents who indicated that their firm did not use GAS were asked to identify factors for not implementing GAS in auditing. Compared to the question for those who are using GAS, the items for each factor are presented in the opposite to the questions posed to those respondents who adopted GAS. Responses to 41 items have been collected to predict auditor usage of GAS. Based on EFA, out of 41 items, eight of them have a factor loading below +0.50 and one item is cross-loaded on two different factors. There are also two factors which only have one item each. As one item is not strong to support the item construct, both of the factors and items have been deleted from the analysis. Thus, a total of 11 items are deleted from this analysis. The results in Table XII show that all of the 30 items exhibit large factor loadings represent by six factors.

The factors were labeled as:

(1) Organizational resource and support (factor loading between 0.681 and 0.791).

(2) Personal knowledge and experience (factor loading between 0.506 and 0.791).

(3) Technological (factor loading between 0.657 and 0.747).

(4) Audit profession (factor loading between 0.505 and 0.850).

(5) Client (factor loading between 0.555 and 0.886).

(6) Cost and resources (audit engagement) (factor loading between 0.612 and 0.642).

Descriptive statistics were computed after eliminating some of the variables in the factor analysis are shows in Table XIII. The questionnaire asked respondents how strongly they agreed with the factors for not implementing GAS in their firm. The degree of these factors was measured by agreement through a Likert scale represented by 1-5, where 1 is strongly disagree and 5 strongly agree. In this result, a mean value 3 and above show fair agreement toward the factors for not implementing GAS, while mean value below 3 indicated lower level of agreement of the factors.

Exploration using open-ended questions assisted in understanding the views of the respondents. One of the respondents mentioned that:

> Our clients are generally low risk, small owner managed businesses which mostly have simple accounting and control systems. For most there is no need to use GAS. There may be a couple of audits where it might be useful but it would not be practical or cost effective to procure GAS and train staff for such a small proportion of our work.

Other auditors are resistant to the use of GAS because of their negative perception of the technology. One respondent reported:

> We recently changed our audit packs and decided to stay with a paper based system mainly because reviews from peers indicate that the GAS are cumbersome and hard to use. The adoption process is lengthy and the learning curve would increase costs to jobs by approximately 100% in the first year.

Surprisingly, one of the auditors did not know that GAS existed mentioning that, "No vendor has ever presented to us its use and effectiveness. It is not promoted."

One auditor recognized advantages of implementing GAS within their firm, but failed to persuade the board to implement GAS. In term of cost, one respondent calculates:

	Component[b]					
	1	2	3	4	5	6
Inadequate maintaining cost	0.791					
Inadequate implementing cost	0.784					
Ineffective and inadequate INTERNAL training for staff	0.783					
Less IT support from IT staff	0.757					
Less support from top management	0.737					
Unavailability of IT audit expertise in organization	0.735					
Ineffective and inadequate EXTERNAL training for staff	0.712					
Insufficient resource to use GAS	0.681					
Insufficient knowledge to use GAS		0.791				
Unfamiliar with computerized auditing		0.746				
Less experience with larger audit clients		0.684				
Hard to understand of the application		0.665				
Prefer to use traditional audit rather than using GAS		0.623				
Difficult to become skillful using GAS		0.606				
Less of IT knowledge		0.566				
GAS is not regularly used in audit assignment		0.506				
Difficult to modify and upgrade			0.747			
No sufficient documentation to follow			0.723			
Difficult of use			0.657			
Professional audit judgment				0.850		
Level of audit risk				0.836		
The existence of audit methodology to follow				0.795		
Not required by auditing standards				0.621		
It is voluntary to use GAS				0.505		
Complexity of client's IT environment					0.886	
Complexity of client's business environment					0.870	
Strength of client's internal control systems					0.729	
Less support provided by client's IT personnel					0.555	
Workloads on multiple audit engagement						0.642
Financial budget on audit engagement						0.612

Table XII.
Factor analysis for not using GAS – rotated component matrix[a]

Notes: [a]Rotation converged in 13 iterations; [b]component: 1 – organizational resources and support; 2 – personal knowledge and experience; 3 – Technological; 4 – Auditing; 5 – Client; 6 – cost and resources (audit engagement); extraction method: principal component analysis; rotation method: Varimax with Kaiser normalization

> Initial cost is expensive; cost analysis from another firm that has implemented GAS show a 25% cost increase during the first year, a 15% cost increase during the 2nd year and minimal benefits from year 3 onwards.

Thus, based on the above findings, a new adjusted research model has been developed. Instead of one group of factors that influence the use of GAS by external auditors, there are another group of factors for not implementing GAS. Figure 2 shows the adjusted research model that contributes the GAS usage by external auditors.

This model contributes an alternative way of understanding the adoption of GAS by external auditors. In real practices, the perceptions of auditors on the use of GAS are different among those who are using GAS and those who are not using GAS. There are nine main factors that influence the use of GAS among the external auditors who use

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)	Mean	SD
Organisational resources and support						2.79	
Inadequate maintaining cost	19	24	74	27	6	2.85	0.995
Inadequate implementing cost	19	25	71	28	7	2.86	1.017
Ineffective and inadequate INTERNAL training for staff	24	39	61	24	2	2.61	0.982
Less IT support from IT staff	21	37	72	16	4	2.63	0.944
Less support from top management	21	26	67	33	3	2.81	1.001
Unavailability of IT audit expertise in organization	17	35	43	39	16	3.01	1.176
Ineffective and inadequate EXTERNAL training for staff	21	41	70	17	1	2.57	0.893
Insufficient resource to use GAS	19	25	51	45	10	3.01	1.117
Personal knowledge and experience						3.20	
Insufficient knowledge to use GAS	10	24	45	62	9	3.24	1.015
Unfamiliar with computerized auditing	9	28	44	52	17	3.27	1.079
Less experience with larger audit clients	11	34	39	51	15	3.17	1.114
Hard to understand of the application	12	27	86	22	3	2.85	0.841
Prefer to use traditional audit rather than using GAS	4	10	36	77	23	3.70	0.903
Difficult to become skillful using GAS	9	30	80	26	5	2.92	0.863
Less of IT knowledge	16	37	71	25	1	2.72	0.891
GAS is not regularly used in audit assignment	4	8	42	67	29	3.73	0.926
Technological						2.94	
Difficult to modify and upgrade	11	16	97	24	2	2.93	0.783
No sufficient documentation to follow	10	18	92	27	3	2.97	0.806
Difficult of use	11	22	87	26	4	2.93	0.849
Audit profession						3.53	
Professional audit judgment	6	8	47	72	17	3.57	0.907
Level of audit risk	5	13	61	56	15	3.42	0.907
The existence of audit methodology to follow	6	5	54	64	21	3.59	0.913
Not required by auditing standards	4	9	47	66	24	3.65	0.913
It is voluntary to use GAS	8	11	58	54	19	3.43	0.986
Client						3.03	
Complexity of client's IT environment	11	31	62	36	10	3.02	1.006
Complexity of client's business environment	11	33	67	31	8	2.95	0.968
Strength of client's internal control systems	9	26	70	36	9	3.07	0.946
Less support provided by client's IT personnel	9	20	81	30	10	3.08	0.916
Cost and resources (audit engagement)						3.01	
Workloads on multiple audit engagement	16	18	82	32	2	2.91	0.900
Financial budget on audit engagement	15	16	55	55	9	3.18	1.043

Note: $n = 150$

Table XIII.
Factors for not implementing GAS

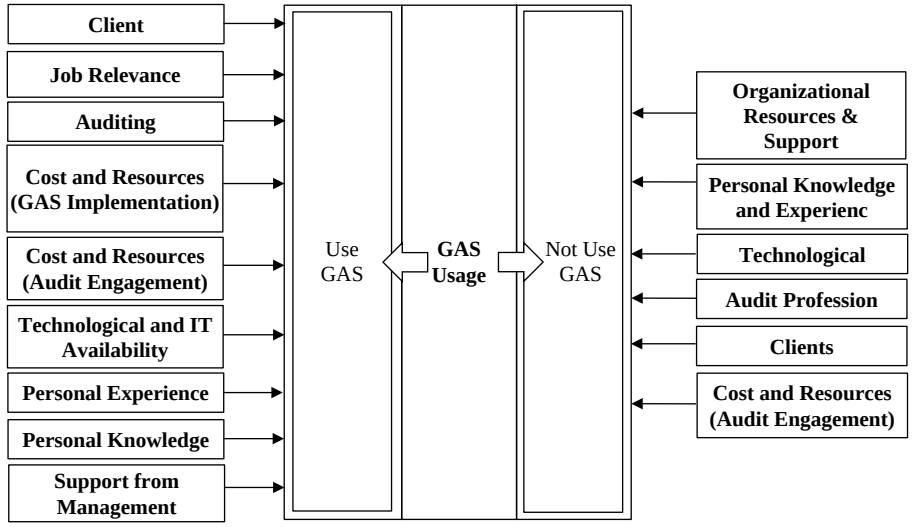

Figure 2.
Adjusted research model on GAS utilization

GAS while only six significant factors influence the use of GAS by external auditors who are not using GAS as shown in Figure 2.

Conclusion, limitations and future research

This study found that GAS usage by external auditors remains relatively low. To obtain an understanding of the factors that influence the use of GAS, we obtained data by means of an online survey from 205 statutory auditors within the UK representing mid-tier and small auditing firms. Results indicate that the following are the factors may increase the likelihood that auditors will use GAS:

- Client – includes all the aspects related to the auditee while the auditors are auditing the client's account. For example, it might include client's environment, internal controls, support and size.
- Job relevance – includes aspects about an auditor's perception of how the use of GAS is important to their job and career progression.
- Auditing – includes all the aspects that relate to the audit profession. It includes audit methodology, auditing standards and professional judgment of auditor.
- Cost and resources (GAS implementation) – includes all aspect which relates to the cost and available resources to implement GAS.
- Cost and resources (audit engagement) – includes all aspects which relate to the cost and available resources for a particular audit engagement.
- Technological and IT availability – includes all aspects which are related to technology and IT availability, including the human resource and IT infrastructure.
- Personal experience – includes all aspects relating to an auditor's experience.
- Personal knowledge – includes all aspect that relate to an auditor's knowledge.
- Support from management – includes all aspect that relate to the support from management for the use of GAS.

The findings of this study also provide some reasons for the limited use of GAS. The study suggests that the following are the reasons an external auditor might choose not to adopt GAS:

- Organizational resource and support – includes all the aspects related to a firm's resources and the support from the management. Resources may include the cost of implementation and maintaining of GAS and training of staff.
- Personal knowledge and experience – includes all the aspects related to individual auditors' knowledge and experience in computerized auditing.
- Technological – includes all the aspects related with the difficulty of using GAS.
- Auditing – includes all the aspects related to the audit profession.
- Client – includes all the aspects related to a client's environment, internal control systems and support.
- Cost and resources (audit engagement) – includes all the aspects related to limitations in the audit engagement.

Some responding auditors did not know that GAS existed. While some of them felt that it was not worth implementing GAS because the overhead of adoption outweighed the benefits given the small size of their clients or the limited number of clients they had. The findings reinforce and add to those of existing studies, especially in understanding the adoption and non-usage of technology by professional auditors within small and medium size of accounting firms.

This paper has proposed a consolidated set of factors which influence auditors' decisions to adopt GAS. Although the findings are relevant primarily for SMEs, it is this group that is most resistant to GAS adoption and for which further work should be undertaken. By better understanding the factors outlined in this paper, practitioners and vendors have the opportunity to adapt existing GAS offerings in order to address some of the misgivings of auditors who are resistant to adoption. Researchers and professional bodies will also be informed in order to develop appropriate professional development in order to encourage GAS acceptance in the future.

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